The Cognitive Web

Critical
Thinking
On the
Web

Presentation to the Semantic Web
Interest Group

November 1st, 2002.

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The Cognitive Web

Presentation Abstract

Critical Thinking On the Web

The Cognitive Web is a human-centric web architecture comprised of semantic markup and fuzzy logics designed to support collaborative decision-making, critical thinking and conflict resolution processes. The goal of the Cognitive Web is to extend human decision horizons by compensating for some intrinsic aspects of selective attention.

The Semantic Web is based on Berners-Lee's notion that "semantic" means "machine-processable" – it enables machines to understand the content on the Web. The Cognitive Web is a cognitive and computational model of expert memory – it enables humans to reason about and address issues using a collaborative infrastructure. The Cognitive Web shares much of the Semantic Web infrastructure (XML, semantic models, annotation systems, inference systems), but goes much further. At the same time, there are sharp differences, including a human-centric and fuzzy logic focus in contrast to the machine interchange of digitally signed proofs achieved through crisp logics.

This presentation will explore some of the motivating assumptions of a Cognitive Web and its relationship to the architecture, algorithms, and assumptions of the Semantic Web.

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Touchstones

1. Externalities

2. Decision-horizons

3. Focus of Attention

4. Enlightened Self-Interest

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Background

- Inspired by research on human cognition, expert decision-making, and computational models of reflexive inference.
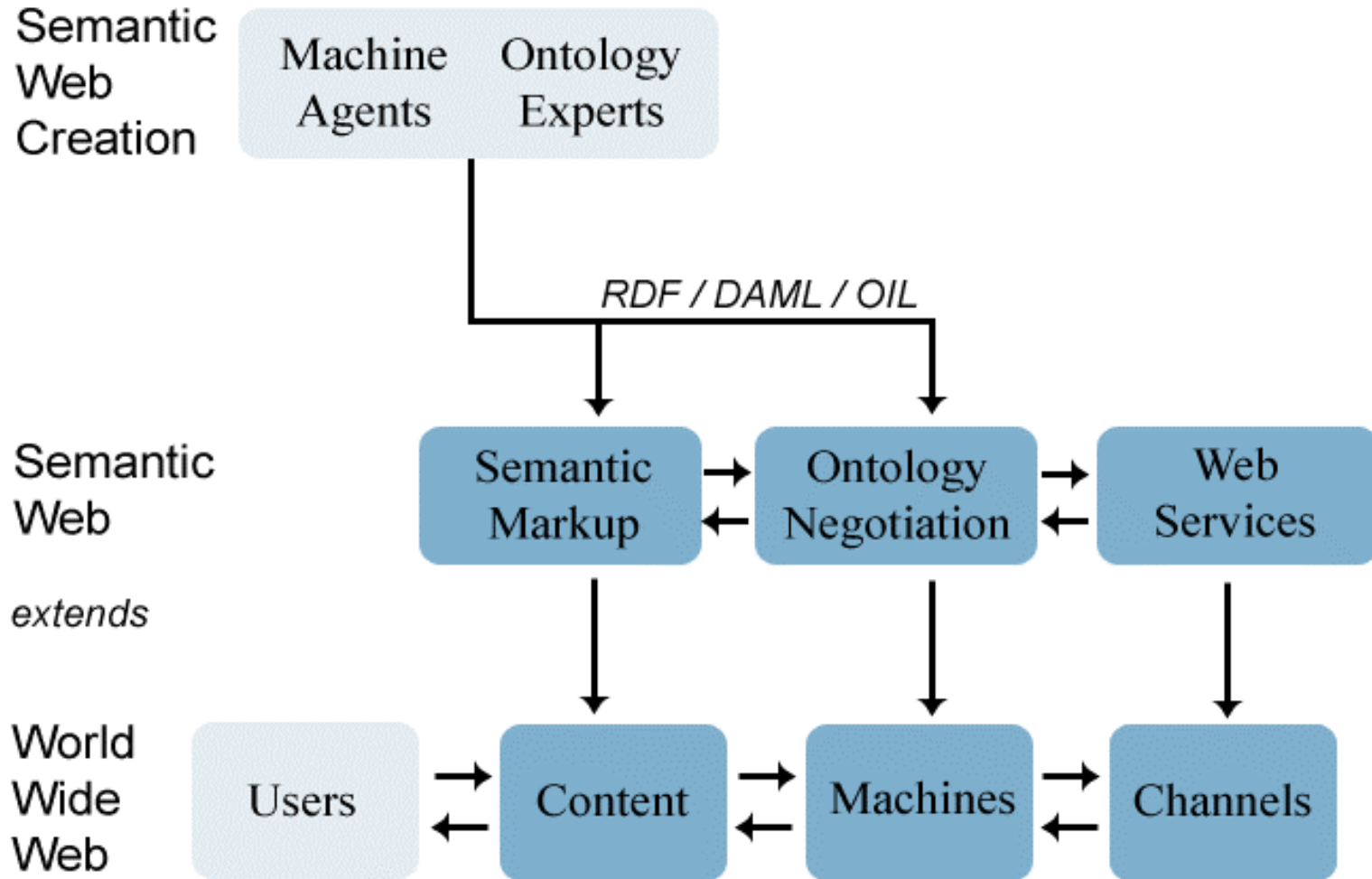
Contrasting Design Goals

- Semantic Web
  - (Digital) Web of Trust (among machines).

- Cognitive Web
  - Incorporate externalities by correcting attention bias.
  - Co-opt people within existing workflow.

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Semantic Web Architecture

Semantic
Web
Creation

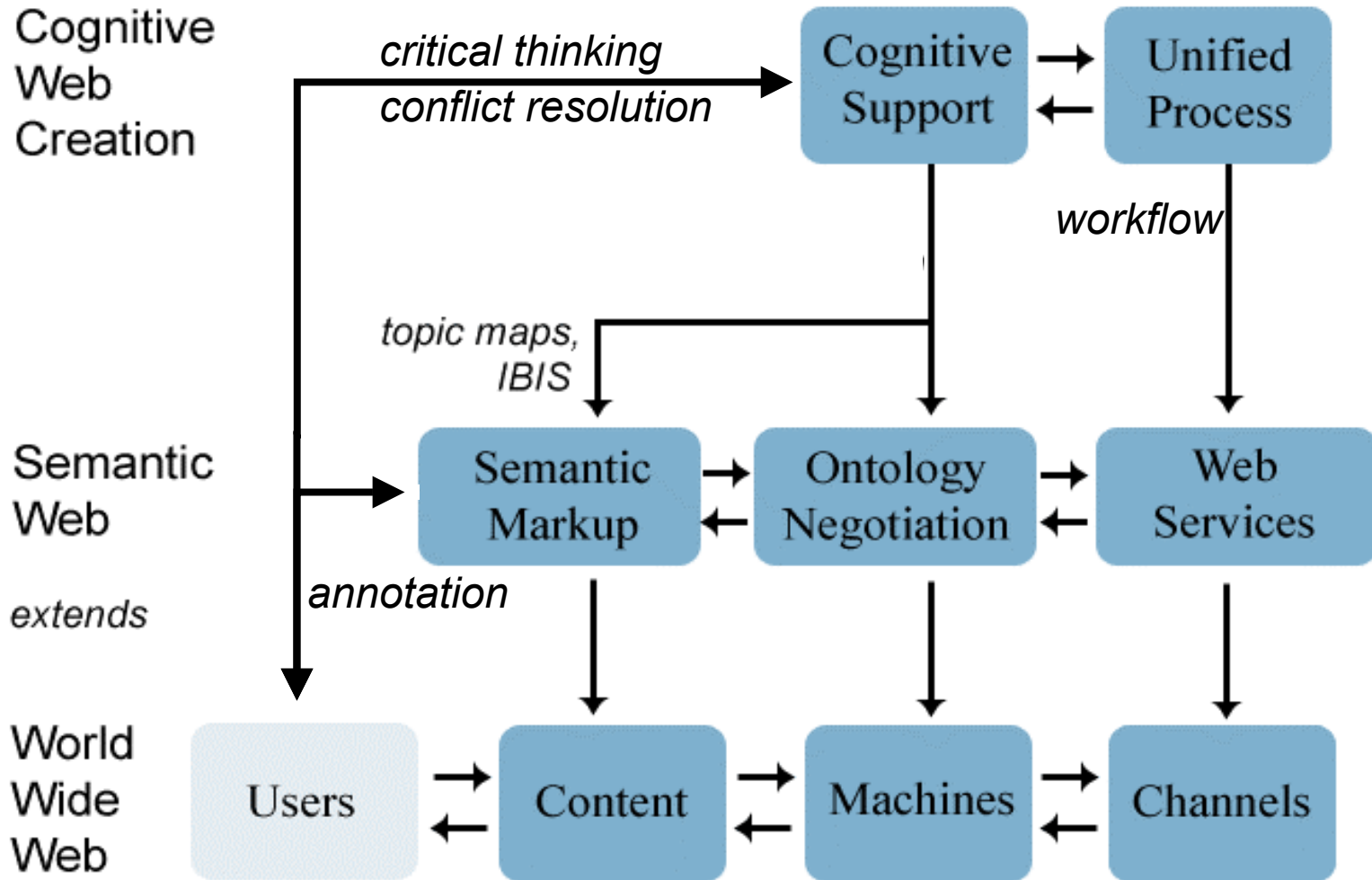| Machine Agents | Ontology Experts |

RDF / DAML / OIL

Semantic
Web

| Semantic Markup | → ← | Ontology Negotiation | → ← | Web Services |

extends

World
Wide
Web

| Users | → ← | Content | → ← | Machines | → ← | Channels |

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Cognitive Web Architecture

Critical
Thinking
On the
Web

Cognitive Web Creation

critical thinking
conflict resolution

Cognitive Support → Unified Process

workflow

topic maps, IBIS

Semantic Web

extends

Semantic Markup → Ontology Negotiation → Web Services

annotation

World Wide Web

Users → Content → Machines → Channels

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The Semantic Web

- Extension of current web

- Crisp, monotonic machine inference

- Based on digitally signed facts and proofs
  - Focus on agents, agent service discovery, tools for authoring semantic tags, ontology negotiation

Semantic Web Issues

- Large complex systems with crisp decision boundaries
  - are fragile; and
  - lacks feedback dynamics to evolve and maintain coherent systems
- Where does that nice crisp information come from?
- What use is incomplete, unreliable or conflicting information?

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The Cognitive Web

- Extension of current web
- System of Systems
  - Users, machines, content, channels
  - Users are source of models and values
- An extension of the human mind
  - Like paper and writing
  - Facilitates sharing and recall of experience
  - Identifying and exploring difference

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Cognitive Web Algorithms

- Non-monotonic, fuzzy inference

- Maintained by users

- Facilitated by computational systems

- Translates worldly objects and events into support for and against positions on issues

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Normative decision theory

- The normative model requires
  - exhaustive generation of outcomes; or
  - comparison of alternatives

- Yet experienced decision makers
  - few instances of analytical processes, and
  - a wealth of instances in which experts attempt to create and verify coherent *stories*.

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Underlying models

- Reflexive recognitional processes
  - Causal world models that synthesize
  - *Stories* as coherent recognitional products.

- Strategies for effectively
  - facilitating recognition
  - verifying its results, and
  - constructing more adequate models when recognition fails
  - Argument models

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Reasoning from evidence

U.N. Warns of African AIDS Toll

By David Brown
Washington Post Staff Writer
Wednesday, June 28, 2000; Page A01

AIDS will cause early death in as many as one-half of the young adults in the hardest-hit countries of southern Africa, causing population imbalances nearly without precedent, according to a report released by the United Nations yesterday.

The AIDS epidemic is already measurably eroding economic development, educational attainment and child survival--all key measures of national health--in much of sub-Saharan Africa. The disease's ultimate toll on the region…

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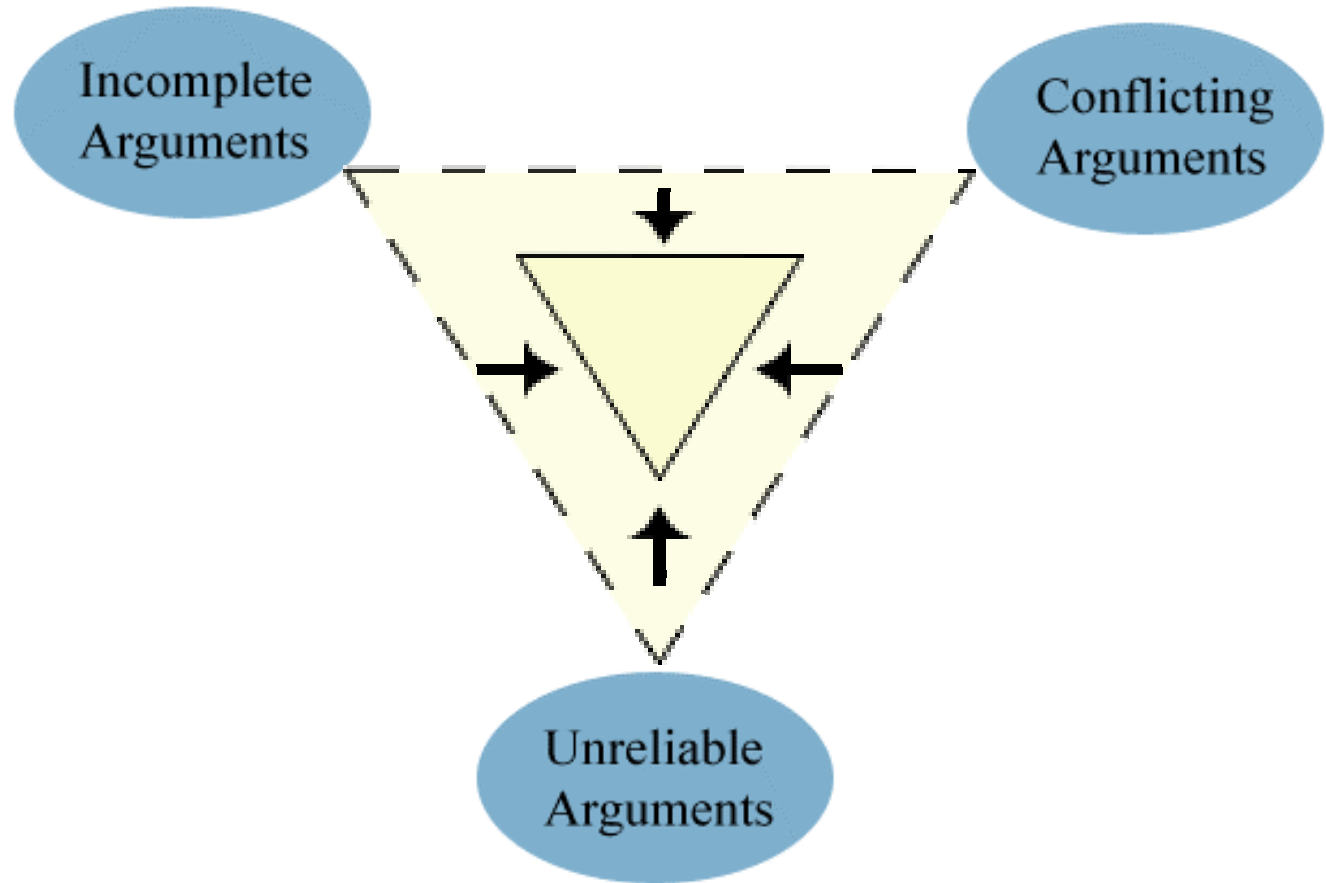
Argument Structure

- Integrates all *evidence* supporting the argument, *rebuttals* for the argument, and the *conclusions* claimed by the argument.

- User may modify the argument, seek to reconcile variations in the argument, e.g., contributed different people.

- The basis for the argument is captured in its *rationale*.

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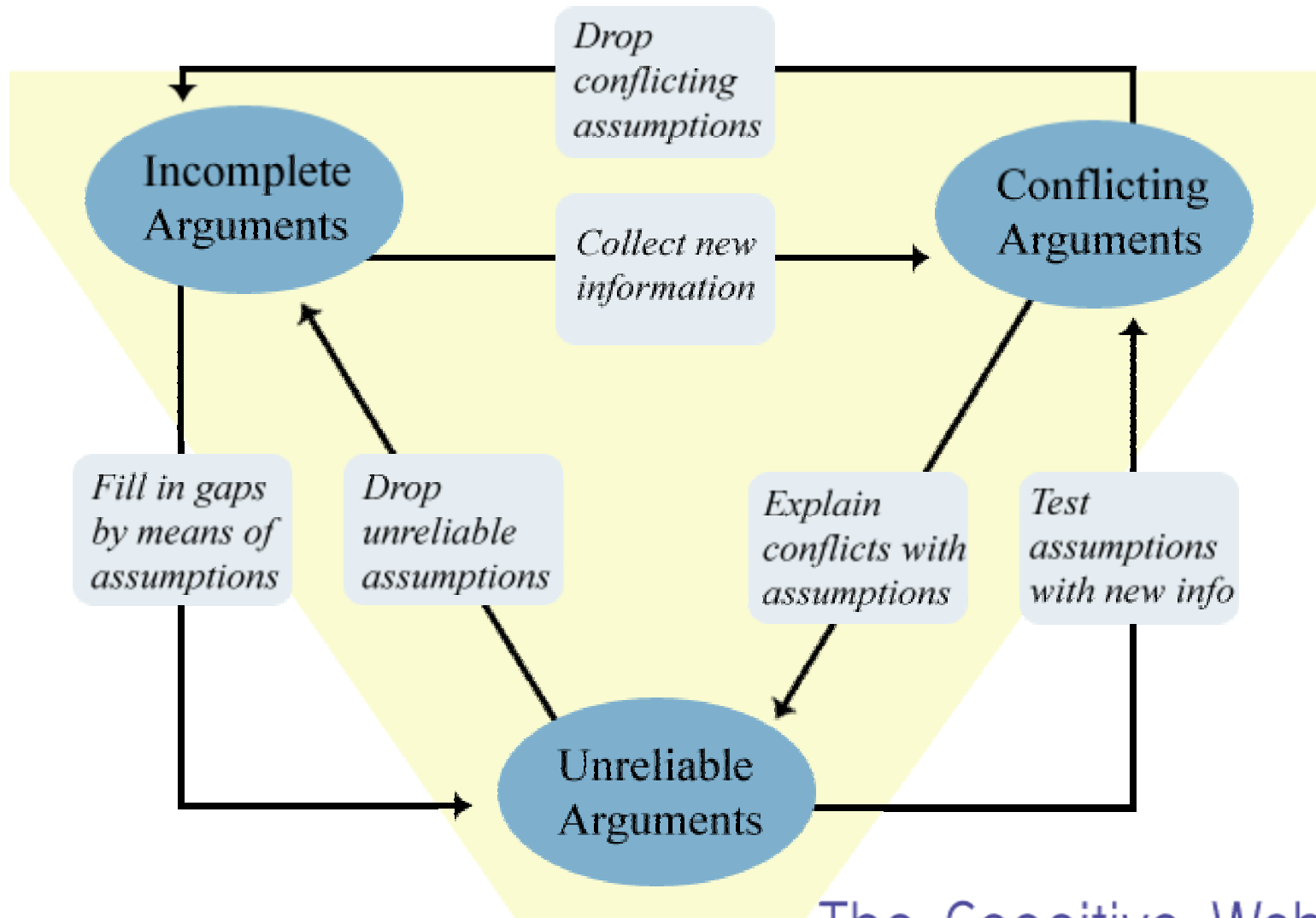# Kinds of Uncertainty

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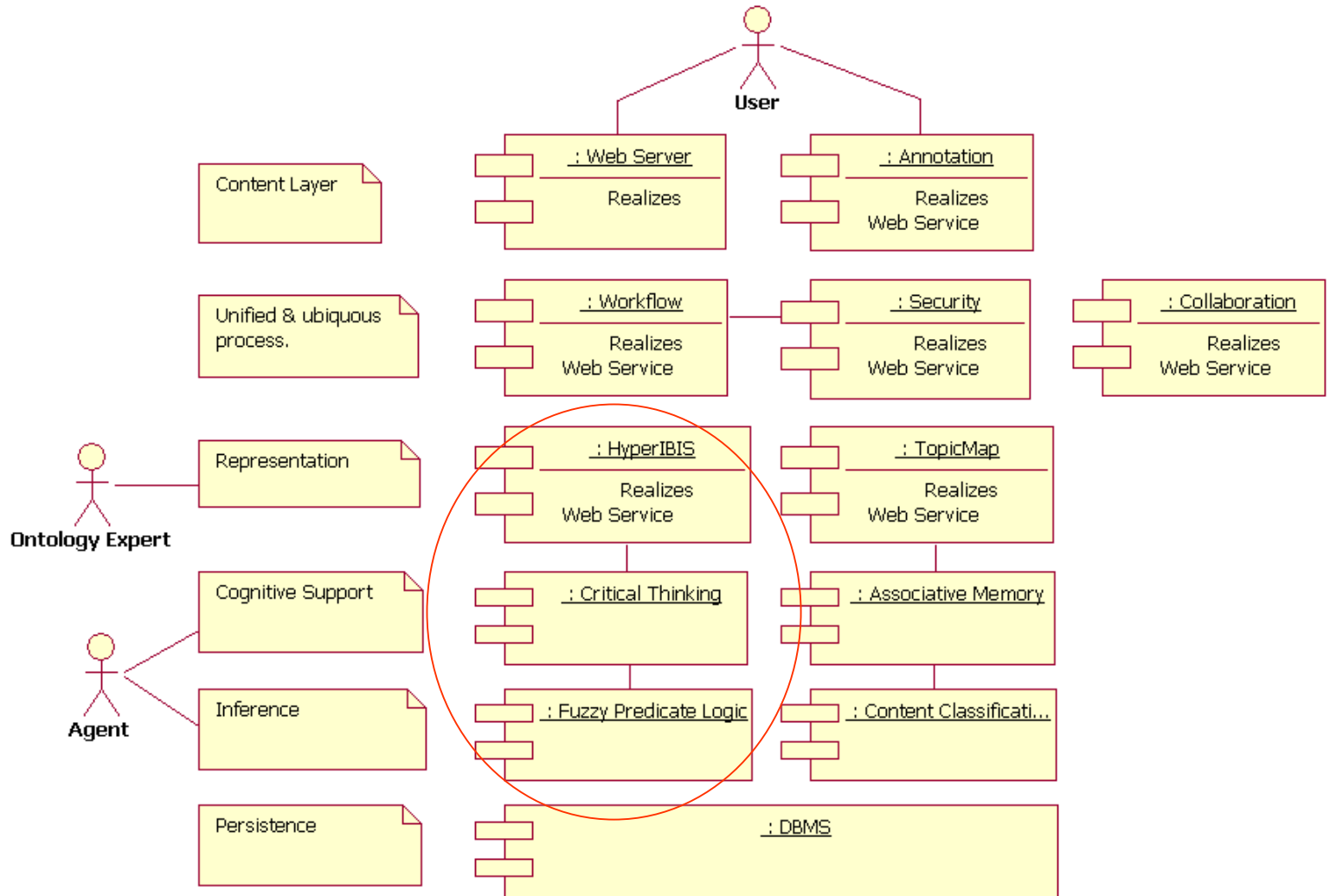# Attention Shifting

Architectural components

- Associative memory
  - textual search within topic systems (XML Topic Maps)

- Interpretive memory
  - fuzzy inference over causal and argument models (Toulmin / IBIS)

- Critical thinking support
  - feedback loops to monitor and correct lines of reasoning

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Notional Component Arch.

Acknowledgements

- Inspiration is due to the work of many, including the founders and members of GlobalWisdom, the Global Brain project, and the members of the XML Topic Map standards body. Similar issues are being explored by Nexist.Org and Bootstrap.Org.

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